

## Interventions for Providing Cookies Based on Red Nuts, Banana, and Snakehead Fish as an Emergency Food Alternative Towards Nutritional Status of Children

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**Abstract**—The disaster's fundamental impact is the emergence of health and nutrition problems among disaster victims, especially those with nutrition vulnerability, namely infants and toddlers. Providing food assistance in instant noodles, instant porridge, or rice is less effective because it requires processing before consumption. Cookies are a food product that the community is well accepted, including being used as emergency food products. The research design used a quasi-experiment pre-test to compare children's nutritional status under five in the intervention and control groups. The sample was 30 toddlers per group. The total sample was 60 for 15 days of intervention. The data collected were sample characteristics, food intake, nutritional status, proximate analysis, protein. Food intake before the intervention, namely energy ( $p = 0.874$ ), protein ( $p = 0.873$ ), fat ( $p = 0.6630$ ), carbohydrates ( $p = 0.542$ ), fiber ( $p = 0.677$ ), there was no significant difference, while for energy ( $p = 0.718$ ), fat ( $p = 0.309$ ), carbohydrates ( $p = 0.074$ ), fiber ( $p = 0.211$ ) there were no significant differences. There is a difference in nutritional status on the weight/age index before and after the intervention ( $p = 0.035$ ). Note that on the index height / age ( $p = 0.240$ ) and index weight / height ( $p = 0.678$ ) there is no difference. The highest protein score calculation for Cookies products is Laucyn at 136.69, while the limiting amino acid lies in Sulfur Amino Acid (SAA) at 72.84.

**Keywords:** Cookies, Red Nuts, Banana, and Snakehead Fish, Emergency Food Alternative

### 1. INTRODUCTION

The disaster's fundamental impact is the emergence of health and nutrition problems among disaster victims, especially those with nutrition vulnerability, namely infants and toddlers (under five years old). Toddlers in Indonesia still experience malnutrition. Many factors influence the state of malnutrition, including insufficient food intake and infectious diseases. The national prevalence of malnutrition in 2014 was 13.0%, stunting 17.1%, thin 13.3% [19]. Research conducted by the Ministry of Health and UNICEF on East Timorese refugees in East Nusa Tenggara shows that 24% of children under five are underweight.

In comparison, in West Kalimantan, the prevalence of malnutrition among refugees is 10.8%. If the prevalence of malnutrition is 10-15%, then the refugee location condition is critical [19]. In general, refugee camps in Indonesia have minimal availability of clean water and fuel for cooking. Therefore, food assistance is needed that can be consumed directly and does not require processing but can meet daily nutritional needs. Providing food assistance in instant noodles, instant porridge, or rice is less effective because it requires processing before consumption. The nutritional content is only limited to carbohydrates, while for human growth, especially infants and toddlers, need other nutrients such as protein, fat, vitamins, and minerals. Also, based on data collected from the Aceh Jaya Post after the floods in November 2014, out of 729 toddlers in the Sampoiniet sub-district evacuation, 37 children were experiencing severe underweight, and 106 children were experiencing underweight.

So far, disaster victims' emergency food aid is mostly aimed at adults, such as instant noodles. However, under-five disaster victims need better nutritional intake. Therefore, the main priority for handling toddlers

is prevention and treatment, namely by improving feeding for infants and children. Fulfillment of nutrition for children under five is obtained from emergency food products [18].

Emergency food products must be of direct consumption and suitable for all ages, from children aged six months to the elderly. There are five emergency food characteristics: safe, acceptable taste, easy to share, easy to use, and complete nutrition. Many types of emergency food products have been developed in the form of IMF processing (intermediated moisture food), cookies, and food bars.

Cookies are a food product that the community is well accepted, including being used as emergency food products because they taste good, have a long shelf life, and are easy to consume anywhere and anytime. Cookies can be a medium for improving nutrition when formulated with certain ingredients. Aziz conducted previous research in 2008 by making cookies from various ingredients used as an alternative product for emergency food. The protein quality of toddler cookies is determined by the protein content in the food and the amino acid composition. BMC calculates the amino acid score on cookies for toddlers with a value reaching > 69. Cookies with high protein quality can be produced by selecting local food-based foods. In terms of local resources, the region, and natural resources, Indonesia has the potential for various food availability, both food for sources of carbohydrates, protein, fat, vitamins, and minerals. With many advantages, local food ingredients, both in nutritional content and agronomic aspects, are red beans, bananas, and snakehead fish.

Red bean (*Phaseolus vulgaris* L) is a functional food that has not been widely used. The amount of red bean production in 2015 was 110,051 tons; in 2016, it was 116,397 tons [4]. Increasing the production of red beans has an important meaning in supporting community nutrition because it is a source of vegetable protein that is cheap and easy to develop. Red beans are rich in folic acid, calcium, complex carbohydrates, fiber, and relatively high protein. Compared to other legumes, red beans have the highest carbohydrate content, and fiber content in red beans is much higher than rice, corn, sorghum, and wheat. Large kidney beans contain essential amino acids and are rich in fiber 2.1 g [4].

Bananas contain fructooligosaccharides as prebiotics that can prevent diarrhea [Gibson, 1998]. The distribution of bananas is very wide from the lowlands to the highlands. The nutritional content per 100 g of bananas is 108 kcal, 1.0 g protein, 0.8 g fat, 24.3 carbohydrates, 20 mg calcium, 30 mg phosphorus, 0.2 mg iron. Bananas have an advantage over other types of bananas, namely a sweeter taste with a sugar content of 20%. The amino acid content of bananas is quite rich in Lysine and cysteine. Banana production in Indonesia in 2015 was 5,755,073 tons, increasing to 6,132,695 tons in 2016 [4].

Snakehead fish is one of the most widely used fish for food. The protein content of snakehead fish is 25.5%, and this is higher than sardines (21.1%), milkfish (20.0%), snapper (20.0%), catfish (17.71%), and goldfish (16.0%). Furthermore, snakehead fish' protein content is higher than foodstuffs known as protein sources such as eggs, chicken, and beef. The protein content per 100 grams of snakehead fish is 20.0 grams and is higher than 12.8 grams of eggs, 18.2 grams of chicken meat and 18.8 grams of beef. Gantohe conducted previous research in 2012 to formulate functional cookies based on snakehead fish meals for toddlers. The formula with the addition of a 15% snakehead fish meal is the most preferred product.

Cookies with high protein quality can be produced by selecting local food-based ingredients. One of them is to use composite flour from red beans, bananas, and snakehead fish. Ekafitri carried out previous research in 2014 using nuts as a raw material for protein sources for emergency food. Based on this, it is necessary to

carry out a study entitled "Intervention of Giving Cookies Based on Red Beans, Banana, and Fish Cork as an Alternative to Emergency Food for the Nutritional Status of Toddlers."

**2. METHOD**

This study used a quasi-experimental design pre-test - post-test. The study design compared the nutritional status of children under five before and after the intervention. The interventions given were: The activity of providing cookies is carried out by nutrition officers to mothers or caregivers of toddlers every day for 15 days. The research site was conducted in Bojong Asih Village, Dayeuhkolot District, Bandung Regency because it is a flood disaster area during the rainy season. Based on the 2018 Toddler Advisory Month Report, nutrition problems are underweight (4.0%), short (3.35%), and thin (1.46%). The research was conducted in March - September 2019. This study's population were toddlers in the Bojong Asih Village area, Dayeuhkolot District, Bandung Regency, West Java Province.

Samples were toddlers in RW 04 and RW 14, Bojong Asih Village, Dayeuhkolot District, Bandung Regency, West Java Province. The number of samples is calculated based on the following formula (Lameshow, 1990) for 30 children under five who experience mild malnutrition.

**3.RESULTS AND DISCUSSION**

**3.1. Sample Characteristics**

Table 1 Sample characteristics according to gender, father's education, father's occupation, maternal education, and maternal occupation

Variable	Intervention Group		Control Group	
	n (30)	%	n (30)	%
Gender				
Male	14	46.7	17	74,0
Female	16	53.3	13	26,0
Father's education				
Not completed in primary school	3	10,0	1	3,3
Primary School	4	13,3	4	13,3
Junior High School	5	16,7	9	30,0
Senior High School	18	60,0	10	33,3
Diploma	0	0,0	3	10,0
Bachelor	0	0,0	3	10,0
Father's job				
Private employees	14	46,7	9	30,0
Entrepreneur	7	23,3	6	20,0
Laborer	9	30,0	15	50,0
Mother's Education				
Not completed in primary school	2	6,7	1	5,0
Primary School	4	13,3	2	10,0
Junior High School	7	23,3	12	31,7
Senior High School	15	50,0	12	45,0
Diploma	2	6,7	1	5,0
Bachelor	0	0,0	2	3,3

Mother's job				
Civil servants	9	10,0	4	13,0
Private employees	2	6,7	2	6,7
Traders	3	10,0	3	10,0
Housewife	16	53,3	21	70,0

Table 1 shows that the sex of the largest sample in the intervention group was female by 53.3% and in the male control group by 74%. In the intervention and control groups, most fathers' education was mostly in high school education, 60% 33.3%. Most fathers' jobs in the intervention group work as private employees, and in the control group, the most work as laborers. Most Mothers' education, both in the intervention and control groups, mostly works as high school education, respectively 50% and 45%. Most mothers in the intervention group and the control group worked as housewives, 53.3%, and 70%.

### 3.2. Research Subjects Food Intake

Table 2 The food intake of research subjects before the intervention between the intervention group and the control group

Variable	Intervention Group(n=30)			Control Group(n=30)			p*)
	Mean	SD	Min-Maks	Mean	SD	Min-Maks	
<b>Energy</b>	949,18	384,98	337,10-1924,90	934,59	321,21	361,50-1618,70	0,874
<b>Protein</b>	18,97	3,24	9,80-25,30	19,12	2,69	12,70-25,30	0,873
<b>Fat</b>	9,10	15,21	37,60-64,30	32,25	13,46	9,10-58,70	0,677
<b>Carbohydrate</b>	119,67	49,95	55,20-291,70	105,02	24,55	118,54-219,37	0,542
<b>Fiber</b>	4,91	1,86	2,30-9,90	5,11	1,83	2,10-9,00	0,677

\*) Independent T-test

Table 2 shows that there is no significant difference in the food intake of the research subjects in the intervention group and the control group for energy with a value of  $p = 0.874$  ( $p < 0.05$ ), protein  $p$ -value = 0.873, fat  $p$ -value = 0.677, carbohydrate  $p$ -value = 0.542, fiber.  $p$ -value = 0.677 and zinc value  $p = 0.454$ . It means that nutrient intake conditions in the intervention group and the control group before the intervention were the same.

### 3.3 Emergency Food Cookies Formulation

The manufacture of emergency food cookies products uses the Response Surface Methodology (RSM) method. The optimization formulation of flour composition was carried out using a mixture design, with a composition range of 40-50% red bean flour, 40-50% banana flour, and 10-40% snakehead fish flour.

- a. The distribution of panelists' assessment of the overall cookies based on red beans, banana flour, and snakehead fish flour

A picture of the distribution of panelists' assessment of the overall cookies is presented in Figure 1

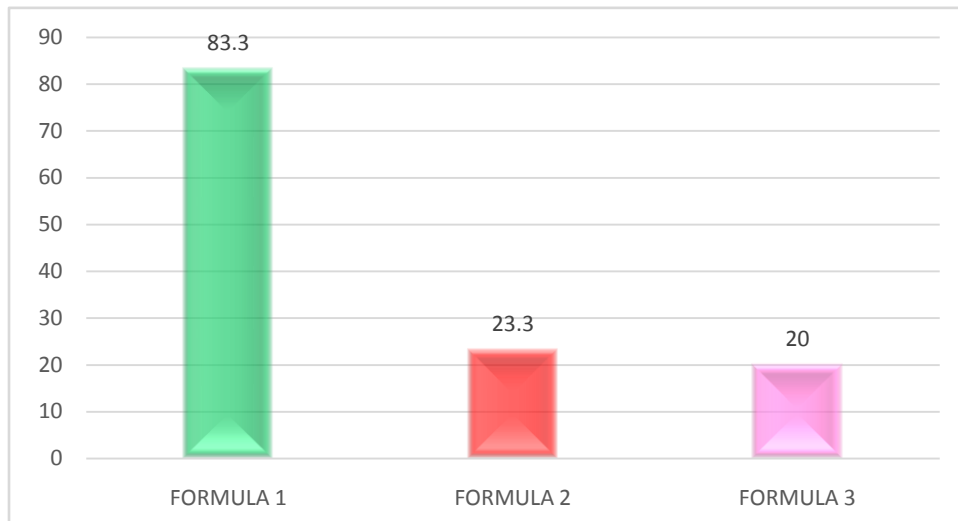


Figure 1

Figure 1 shows that most panelists expressed their liking for the overall formula 1 as 83.3%.

### 3.4 Results of Testing the Nutritional Value of Emergency Food Cookies

The results of the calculation of the nutritional value of mixed cookies are presented in the following table. The yield of red bean flour was 28.6%, banana flour 27.00%, and snakehead fish meal 16%, described in table 3.

Table 3: Calculation results for the mixture of Cookies per 100 grams

Foodstuff	Net weight (g)	Bruto (g)	Energy (Kcal)	Protein (gram)	Fat (gram)	Carbohydrate (gram)
Red Bean Flour	45	157,34	269,06	17,31	3,46	44,06
Ambon Banana Flour	45	166,67	180,00	1,67	1,33	40,50
Snakehead Fish Flour	10	62,50	50,00	10,13	0,31	1,63
<b>TOTAL</b>			<b>499,06</b>	<b>29,10</b>	<b>5,11</b>	<b>86,18</b>

Table 3 shows that the results of the calculation of the nutritional value of mixed food ingredients have met the requirements for the preparation of mixed food ingredients, namely energy in 100 grams of at least 360 Kcal and protein of at least 16%. In calculating the nutritional value of Cookies per 100 grams, the energy value is 499.06 Kcal and 23% protein.

Table 4 The results of testing the nutritional value of cookies per 100 grams

Test Type	Lab Test Results	RDA for 1-5 years old	% RDA
Energy	385 kcal	137,5	280,0
Protein	7,3 gram	2,3	325,1
Fat	1,2 gram	4,8	25,2
Carbohydrate	16,9 gram	21,8	77,7
Fiber	1,9 mg	2,0	50,0
Moisture	2,1 %		

Source: Primary data Lab. UNPAS Food Technology, 2019

Table 4 shows the results that the cookies produced contain nutritional values that meet the nutritional needs of children under five, 385 kcal of energy and 7.3 grams of protein. The results of testing the nutritional value of cookies per serving 60 grams are presented in Table 5.

Table 5 The results of the calculation of the protein score for the mixture of Cookies per 100 grams

	Net weight (g)	Bruto (g)	Try p	Thre o	Isol	Leuc	Lys	SAA	AAA	Val	Total
Red Bean		157,3	336,	1.576	2.064	3.123	2.698	726,9	3.408	2.204	16.13
Flour	45	4	71	,57	,34	,25	,43	2	,04	,37	8,64
Ambon		166,6	16,6							108,3	561,6
Banana Flour	45	7	7	45,00	93,33	98,33	83,33	35,00	81,67	3	7
Snakehead			161,	471,2	551,8	821,2	953,7	926,2	697,5	579,3	5.163,
Fish Flour	10	62,50	88	5	8	5	5	5	0	8	13
MIXED			461,	2.092	2.709	4.042	3.735	1.225	4.187	2.892	21.86
A/E Mixed%			50	,82	,54	,84	,51	,05	,21	,08	3,43
A/E Egg%			2,16	9,80	12,69	18,94	17,50	5,74	19,62	13,55	
Chemical			73,6	101,0		110,7	139,9		100,0		
Score			5	7	98,40	5	9	72,84	8	94,08	

Table 5 shows that the highest protein score lies in the amino acid Lysine with a protein score value of 139.99. Lysine amino acid functions to form carnitine in the body, increasing appetite and producing energy. Cookies products made from red beans, Ambon banana, and snakehead fish have high Lysin content. The protein score calculation obtained the limiting of amino acids in this product, namely the sulfur ammonia acid (SAA) of 72.84.

Table 6 The results of testing the nutritional value of cookies per serving 60 grams

Test Type	Lab Test Results	RDA for 1-5 years old	% RDA
Energy	231 kcal	137,5	168,0
Protein	4,4 gram	2,3	195,1
Fat	0,7 gram	4,8	15,1
Carbohydrate	10,1 gram	21,8	46,6
Fiber	0,6 mg	2,0	30,0

The cookies product's contribution to snack food's nutritional adequacy for the 1-3-year-old age group per 36 grams (12 pieces @ 3 grams) is described in Table 7.

Table 7 Contribution of cookies products to the nutritional adequacy of snack food for 1-3 years age group per 36 grams (12 pieces @ 3 grams)

Test Type	Lab Test Results	RDA for snacks aged 1-3 years	% RDA for
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			Snack
Energy	138,6 kcal	135,0	102,7
Protein	2,6 gram	2,0	130,0
Fat	0,4 gram	4,5	8,9
Carbohydrate	6,1 gram	21,5	28,4
Fiber	0,4 mg	1,9	21,0

The contribution of cookies products to snack food's nutritional adequacy for the 4-6-year-old age group per 39 grams (13 pieces @ 3 grams) is described in table 8.

Table 8 Contribution of cookies products to the nutritional adequacy of snacks for the 4-6-year-old age group per 39 grams (13 pieces @ 3 grams)

Test Type	Lab Test Results	RDA for snacks aged 4-6 years	% RDA for Snack
Energy	150,2 kcal	140,0	107,3
Protein	2,8 gram	2,5	112,0
Fat	0,5 gram	5	10,0
Carbohydrate	6,3 gram	22	28,6
Fiber	0,4 mg	2	20,0

### 3.5 Measurement of Nutritional Status

Giving cookies to toddlers is given for 15 days as much as 60 grams per day. The z value of the nutritional status index of weight/age, height/age, and weight/height before and after the intervention can be seen in table 9.

Table 9 The z value of the nutritional status index score of weight/age, height/age, and weight/height before and after the intervention

Variable	Group	Minimum	Maximum	Mean	SD
<b>The z value of weight index score according to age (BW / Age)</b>					
Pre	Intervention	-1,95	1,49	-0,44	1,13
	Control	-2,42	1,05	-0,39	1,01
Post	Intervention	-1,83	1,05	-0,39	1,10
	Control	-2,41	1,26	-0,26	0,99
<b>The z value of the height index score according to age (height/age)</b>					
Pre	Intervention	-2,91	1,55	-1,25	1,29
	Control	-2,73	1,39	-1,17	1,10
Post	Intervention	-2,90	1,65	-1,20	1,23
	Control	-2,72	1,63	-1,00	1,10
<b>The z value of the weight index score according to height (weight/height)</b>					
Pre	Intervention	-1,94	2,22	0,46	0,93
	Control	-1,07	1,91	0,65	0,83
Post	Intervention	-1,75	2,72	0,47	0,93
	Control	-1,06	2,69	0,58	0,93

Table 9 shows that the mean value of z index scores for weight/age, height/age, and weight/height before the intervention is almost the same.

Changes in nutritional status z score of nutritional status before and after intervention are presented in Table 10.

Table 10 Changes in z score of nutritional status before and after the intervention

Variable	Group	Change in average	SD	p-Value	95% CI
Change in Z score in the Weight Index according to Age (BW / Age)	Intervention	0,28	0,34	0,035	0,01 ; 0,29
	Control	0,13	0,17		
Change in Z score in the Height index according to Age (height / age)	Intervention	0,19	0,26	0,240	-0,04 ; 0,17
	Control	0,13	0,11		
Change in Z score in the Weight Index according to Height (weight / height)	Intervention	0,36	0,34	0,678	-0,16 ; 0,24
	Control	0,31	0,43		

Table 10 shows that the mean change in z score in nutritional status before and after the intervention group intervention was higher than that in the control group. The change in z score in the intervention group's nutritional status was better than in the control group.

### Conclusion

1. The gender of the sample in the intervention group was mostly male (46.7%) in the male control group (34.0%). There was no difference in the sexes of men and women in the intervention and control groups ( $p = 0.438$ ).
2. Most of the father's education in the intervention group was SMA (60.0%), in the control group was SMA (33.3%). Father's job is mostly private employees. Mother's education is mostly high school, and Mother's job is mostly housewives. There was no significant difference in the level of father's education ( $p = 0.064$ ), father's job ( $p = 0.264$ ), maternal education ( $p = 0.418$ ) and maternal job ( $p = 0.458$ ).
3. Before the intervention in the intervention group, the sample's food intake was energy 949.18 Kcal, 18.97 grams of protein, 9.10 grams of fat, 119.67 grams of carbohydrates 4.91 mg of fiber. In the control group, the energy was 934.59 Kcal, protein 19.12 grams, fat 32.25 grams, carbohydrates 105.02 grams, fiber 5.11 mg. There was no difference in energy intake ( $p = 0.874$ ), protein ( $p = 0.873$ ), fat ( $p = 0.677$ ), carbohydrates ( $p = 0.542$ ) and fiber ( $p = 0.677$ ) before intervention in the intervention and control groups.
4. There were differences in intake during the intervention in the intervention and control groups, namely protein ( $p = 0.004$ ), while energy intake ( $p = 0.718$ ), fat ( $p = 0.309$ ), carbohydrates ( $p = 0.074$ ), and fiber ( $p = 0.211$ ).
5. The nutritional value of Cookies per 100 grams is 385 Kcal of energy, 7.3 grams of protein, 1.2 grams of fat, 19.9 grams of carbohydrates, 1.9 mg of fiber.

6. The protein score for Cookies Products is located in Lysine of 139.99 and limiting amino acid in Sulfur Amino Acid (SAA) of 72.84. Cookies products meet the requirements as a mixed food ingredient.
7. There was a significant difference in changes in the nutritional status of the sample based on the weight / age index ( $p = 0.035$ ), while based on the index height / age ( $p = 0.240$ ) and weight / height ( $p = 0.678$ ) there was no difference.

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